Understanding SHAPE in R&D: Bridging the evidence gap

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The British Academy

Contents

A Vision for SHAPE R&D

The Academy has a long history of research on research & development (R&D), from a joint four-Academy study of UK R&D investment by sector funding, sector performance, and region, to R&D explainers and support for initial work into how R&D is measured. This work has highlighted several key issues, not least the exclusion of SHAPE R&D from official statistics,[1] and the possible impact of this exclusion on our understanding of the full breadth of the evidence base. As a result, our recent research endeavours have focussed on a central issue: "How well do we understand SHAPE R&D in the UK?".

Answering this question has required research and analysis on UK data collection and survey instruments; on business understanding of R&D and innovation activities and variations by sector; and on international comparisons of the UK's approach to R&D. This evidence summary collates that work and found that there is a significant risk that UK policy does not accurately reflect the R&D activities which take place,[2] and therefore may be less effective than desired in supporting the government's goal of becoming a 'science and technology superpower' by 2030.[3]

This goal is outlined as the way for the UK to become a "rich, strong, influential country, whose citizens enjoy prosperity and security, and fulfilled, healthy and sustainable lives". Achieving it, according to the new Department for Science, Innovation and Technology, will depend on our existing strengths in science, technology, finance, and innovation.[4] The evidence collated here, covered in more detail in the accompanying reports from Frontier Economics and RAND Europe,[5] outlines the central role of SHAPE disciplines in these strengths. From combining creative and technical skills to create Netflix movies and the use of geographers and economists to understand customer behaviour at Tesco, to the R&D intensive sectors of the UK economy and the role of SHAPE graduates within them.

These examples demonstrate the value of SHAPE R&D, and the value of recognising it alongside the important contributions to R&D from science, technology, engineering, and medicine (STEM) sectors. Yet, they are not examples which are currently well counted or recorded. This is a serious barrier to becoming a science and technology 'superpower', not least because it reduces the accuracy of the evidence base on which policies are developed. There are also issues of the value judgements attached to an evidence base that doesn't give us the full picture – in essence, we need to measure what we value and value what we measure.

Including SHAPE R&D in the UK's R&D evidence base may present an opportunity to ensure that policies aimed at stimulating innovation are appropriate for the sectors which have the greatest potential to contribute to the economy, by taking into account the characteristics of a large amount of previously unrecognised R&D. It would also provide invaluable insight into the various mechanisms of skills uptake and interdisciplinarity; of absorptive capacity by sector and region; and of economic value creation and social impact that emerge from work within the arts, humanities, and social sciences. This will provide long-term learning for policymakers on how to maintain and strengthen an effective, prosperous, and stable relationship between industry and R&D.

Developing this learning is a central tenet of the Academy's work on R&D and innovation and informs much of our next steps in this project, outlined at the end of this briefing. 2020 marks the first time on record in which a global recession did not translate into a drop in R&D expenditures.[6] This reflects an increased understanding of the role that R&D plays in productivity and prosperity, as well as in response to global crises: be they economic or medical. As the UK seeks to capitalise on the success of R&D and innovation, it is critical that we ask ourselves – what should an R&D intensive economy look like? How is it formed, both in shape and structure? Who does it need, and who does it serve? And, as the UK seeks to improve lives and livelihoods through investment in R&D and innovation, we must create a better evidence base to effectively invest across all types of SHAPE and STEM R&D, with the understanding that innovation is at its heart an interdisciplinary endeavour.

Summary

This briefing sets out the evidence to illustrate why a gulf between R&D activities and policy may be occurring, how we might overcome it, and to what end. We hope it is of value to policymakers and analysts of R&D and innovation who are interested in understanding how more effective policies and initiatives can be developed to support the research and innovation system. To be absolutely clear, the analysis and policy insights set out here are not intended to make the argument that one set of disciplines make a greater or lesser contribution to R&D over any other. It is simply to point out where there are gaps in our current systems of measuring R&D and the implications this might have for ensuring our policies are creating the most effective research and innovation system possible.

Each policy recommendation builds on one another to create a holistic approach to fully understanding the contributions of all disciplines to UK R&D and innovation. We end this report with a summary of activity that outlines next steps for the British Academy in mobilising these policy recommendations.

1. **Obtain a full and accurate picture of the R&D evidence base across all sectors and disciplines.**
   UK R&D statistics and data collection should accurately capture and measure SHAPE R&D investment and activities to provide a more effective evidence-base through which to support UK R&D activity.

2. **Ensure policies appropriately recognise the role of R&D in the full innovation system.**
   Alongside collecting better evidence, policy must also recognise that 'formal' R&D is only one part of business investment in innovation. We need to reflect differences between R&D and innovation processes in policy making, as they are easily conflated.

3. **Utilise people-centric methods for measuring R&D.**
   Recognising R&D as part of the full innovation system also means better understanding the role of people across innovation processes. SHAPE R&D is more likely to be embodied in human capital, rather than infrastructure or capital investment. As such, understanding the role that people play in R&D will identify the practices which support innovation and productivity and build on the evidence captured and data collection.

4. **Support interdisciplinary and intersectoral skills for improved economic outcomes.**
   People-centric measurements will also help policymakers better understand the interplay between STEM and SHAPE skills and expertise in R&D. Supporting interdisciplinary collaboration in R&D could create better business outcomes, solve skills gaps, and prepare for the future of work.

5. **Create a holistic and nuanced evidence-base to invest more effectively 3% or more of GDP in R&D.**
   The previous policy goals can help policymakers build a more holistic evidence-base for effective investment in R&D. Investing 3% or more of GDP effectively requires accurate measurements of R&D activities and people, and a systems approach with a long-term vision.

Policy Goals

1. Obtain a full and accurate picture of the R&D evidence base across all sectors and disciplines.

UK R&D statistics and data collection should accurately capture and measure SHAPE R&D investment and activities to provide a more effective evidence base through which to support UK R&D activity. It is vital to develop better, and more fundamental understandings of what SHAPE R&D looks like, alongside its relationship with innovation and productivity, and equip businesses with the skills to report against this.

There is strong evidence to show that:

- SHAPE R&D is currently not well measured in the UK.[7] Though UK policymakers have adopted the OECD Frascati definition of R&D - which has included SHAPE disciplines since 2015[8] - some government bodies exclude SHAPE from their definitions of R&D, e.g. in relation to tax relief. This contrast to the inclusion of SHAPE in the collection of UK official statistics means that businesses may be less likely to report SHAPE research as part of their R&D activities.[9]
- Despite this, SHAPE R&D is likely to be widespread throughout the UK economy,[10] particularly in the 80 % services sector.[11] Businesses recognise SHAPE disciplines as contributing to R&D, but the lack of clarity and consistency in R&D definitions means that they do not know how to measure it.[12]
- Creative sector businesses - which are being innovative and contributing to the UK economy - may be making R&D investments outside the scope of UK tax relief, due to undertaking disproportionate amounts of SHAPE R&D.[13] As a result, such activity would not currently be fully captured, understood, or accurately valued.
- In sum, a stronger, more comprehensive evidence base is vital to understand the contribution of all disciplines to R&D and innovation.

We therefore recommend that:

- The newly formed Department for Science, Innovation and Technology (DSIT) takes a clear leadership role on this issue within government and sets out an agenda for how to address and fill critical gaps in the evidence base.
- The Office for National Statistics (ONS) continues to implement and develop further changes to the Business Enterprise Research and Development (BERD) survey to better capture evidence on SHAPE in R&D

2. Ensure policies accurately recognise the link between R&D and the full innovation system.

As part of collecting better data on the breadth of R&D activities, policymaking needs to reflect differences between R&D and innovation processes, as they are easily conflated. 'Formal' R&D is just one measure of investment in innovation. Innovation also includes processes of discovery, creativity, incubation, and diffusion, alongside factors like knowledge exchange between actors and institutions.[14] SHAPE disciplines play a significant role in the innovation process, both distinct from and working alongside their role in R&D. More evidence is needed to understand how these practices are distinct – or not – in R&D intensive businesses.[15]

We need to broaden both our understanding of what 'counts' as R&D, and of what constitutes investments in innovation beyond R&D. By valuing what we measure and measuring what we value, a better evidence base for policy will emerge.

There is strong evidence to show that:

- R&D and innovation processes and outcomes are different and require different policy support. Formal R&D is only one part of the investments that businesses make in innovation – efforts are usually much wider, particularly in the investment of time and resource on internal innovation teams.[16]
- SHAPE disciplines work across R&D and innovation, though research suggests that R&D and innovation require different skills and disciplinary expertise.[17]
- Across R&D and innovation processes, both SHAPE and STEM expertise and interdisciplinary skills are vital for positive outcomes.[18] This is seen in the skills demands of R&D intensive sectors, as well as in the skills and career paths developed by SHAPE graduates.[19]
- R&D and innovation processes are highly active in sectors that risk being side-lined due to exclusion from government R&D incentives, such as the creative industries and areas of the services sector.[20]
- SHAPE is vital to R&D and innovation processes, but there can be a lack of clarity and understanding about this in policy making.[21]

We therefore recommend that:

- Government departments and funding bodies support further study of R&D and innovation data to understand the specific types of activities, skills and people conducting R&D and innovation, and what outcomes they lead to.
- Policymakers and government departments identify and assess effective policy levers to incentivise connected R&D across SHAPE and STEM activities, particularly in industries where we may be undercounting R&D such as the Creative Industries and areas of the services sector.

3. Utilise people-centric methods for measuring R&D.

SHAPE R&D is more likely to be embodied in human capital, rather than infrastructure or capital investment which is what current R&D statistics tend to measure more.[22] People-centric measurements will help policymakers better understand the interplay between STEM and SHAPE skills and expertise in R&D. Understanding the role that people play in R&D activities will not only help us to better understand the role of SHAPE disciplines in R&D, but also to identify the practices which support innovation and productivity across the board.

There is strong evidence to show that:

- SHAPE R&D is more likely to be embodied in more intangible assets like human capital, rather than infrastructure or capital investment.[23]
- Businesses in the service sectors understand innovation as people-focused, whether that is customer-centric innovation or embedding a culture of innovation across internal ways of working.[24,25]
- Understanding who contributes to R&D projects and the wider R&D ecosystem is a way of better identifying the contributions of a wider variety of subjects and expertise, and to understand the skills that are needed in all stages of R&D and innovation.[26]
- This practice will also help to nuance the SHAPE/STEM dichotomy narrative which can be pervasive in R&D, and ultimately counterproductive in policy and in practice.

We therefore recommend that:

- A people-centric approach to R&D, which recognises and measures human capital within the UK's R&D ecosystem, is used to provide vital insights for R&D policymakers in DSIT, HMT and HMRC.
- Further research is undertaken by the ONS, in partnership with sector bodies such as UKRI and the national academies, to create a more expansive and nuanced understanding of what constitutes an R&D role. This will enable policymakers in DSIT to better understand the key skills required for R&D and how policies across Government might support them.

4. Support interdisciplinary and intersectoral skills for improved economic outcomes.

Inter and multi-disciplinarity expertise and approaches are highlighted as vital by businesses at the forefront of R&D. Valuing the interplay between STEM and SHAPE perspectives in R&D could create better business outcomes, solve skills gaps, and prepare graduates for the future of work identify the practices which support innovation and productivity across the board.

There is strong evidence to show that:

- Of the top five R&D performing sectors, four employed more 'non-science' graduates than science graduates in 2020. As SHAPE graduates make up the majority of 'non-science' graduates, this points to the importance of SHAPE skills and expertise in R&D intensive sectors.[27]
- SHAPE graduates employed in sectors with high levels of business R&D, (including the professional, scientific, and technical; manufacturing; and information and communication sectors) are critical to delivering STEM-based R&D. This may be in-house or outsourced – the latter may be missed by current measures of UK R&D.[28]
- There are strong overlaps between STEM and SHAPE in R&D activity, with different skills and expertise embedded and connected across different settings. This is to be celebrated and enhanced.
- There may be R&D activities in sectors traditionally aligned with SHAPE skills and expertise which are not recorded due to misunderstandings about what 'counts' as R&D, and messages around value from policymakers.[29,30]
- The value of diversity of thought and experience is clearly recognised by businesses, alongside a challenge in recruiting people with diverse backgrounds. The current UK education system tend to put people on binary STEM or SHAPE "pathways" without encouraging cross-over.[31]

We therefore recommend that:

- There be collaboration across the sector to understand how interdisciplinary education and learning can be encouraged across all levels of education, supporting learners to develop a breadth of skills and approaches.
- Sector stakeholders should contribute to government understanding of the practices and processes of R&D – how it is happening on the ground and across disciplinary divides – helping policymakers develop the best policy levers to support R&D.
- There is a continued effort to create better mechanisms and research environments for academics to exchange ideas with businesses. Efforts like the Innovation Caucus, Research England's ASPECT network, the ESRC's Transforming Business Initiative and the AHRC's Creative Industries Policy and Evidence Centre are all good examples.

5. Create a holistic and nuanced evidence-base to invest more effectively in R&D.

The previous policy goals can help policymakers build a more holistic evidence base for investment in R&D. Increasing this investment is a long-standing goal of the UK government, currently set at 3% of GDP, which the Academy believes is vital to remain globally competitive.

Recent updates to the ONS R&D data collection methodology are leading to upward revisions in statistics measuring UK R&D expenditure. The evidence collected by the Academy supports further revisions to the data collection methodologies by broadening the definition of R&D, and this could lead to a further increase in the recorded investment in R&D.

However, it is imperative that this improvement of the evidence base by including what is currently unmeasured – in terms of SHAPE or other forms of R&D – must not be used to 'meet' the investment target and this could amount to just moving the goalposts. Instead, a broadening of R&D data collection should provide a more nuanced evidence base from which to better understand the breadth of R&D activity which results from such investment. This can help the UK Government to fully understand what the right target investments in R&D might be, and the right methods of achieving it to support economic and societal gain.

There is strong evidence to show that:

- The initial target of 2.4% is insufficient for achieving the UK's ambitions to be a science and research superpower, representing less than the OECD average for share of GDP invested in R&D.
- There is a danger that if policy tools are focused on a narrow and incomplete measure of R&D, missing the full breadth of activity across SHAPE and STEM, this could lead to unbalanced growth which skews the country's R&D efforts.

We therefore recommend that:

- DSIT retain the target of 3% of GDP investment in R&D. This is particularly important if measures of R&D are improved, extending the activities included.
- The target of 3% of GDP investment in R&D must sit alongside policies that target the effectiveness of this investment and should include a clear roadmap as to how and when this investment will be made, and over what timeframe.
- The sector collaborates with DSIT and HMT to support the development of tools to offer R&D support across the UK.

Case Studies

The Human Sciences Studio, Accenture

The Human Sciences Studio is part of The Dock in Dublin, and forms part of the Accenture Innovation network.[34] Accenture's website introduces the Studio as a team who *"research and apply expertise in social science, arts and humanities to equip clients for shifting relationships between business, tech and society"*. The existence of the studio is a recognition of the fact that it is *"absolutely critical to bring in thinking from the human sciences into these conversations about technology and innovation"*. The breadth of disciplines they collate offers a *"collision of perspectives"* so they can show *"different ways of looking at a particular problem"*.

One key project includes the Studio's work around the Sustainability Mindsets for Change.[35] The project involved experts within Accenture with multidisciplinary backgrounds, including systems designers, psychologists, design researchers, sociologists, philosophers and experts in cultural studies and identity. This project recognised the fact that, while organisations need scientific-based sustainability targets, they also need to address the cultural side of sustainable change, with a focus on operational, logistical, and human aspects.

The work undertaken by the studio developed a model of human attitudes and behaviours around sustainability which was *"designed to help [clients] understand [their] organisation's behaviours and attitudes towards sustainability, surface [their] biggest internal barriers and start thinking about the right kind of intervention areas to tackle them"*. The model led to interesting conversations with businesses in a range of industries such as banks, insurance, and retail. The model has also helped businesses to recognise that a lot of people do not need to believe or be passionate about the cause to exhibit "sustainable behaviours". Our interviewee noted that *"this insight came from research grounded in the human sciences, but when this is combined with all the other aspects of Accenture, like strategy and technology, it becomes a really powerful force to unlock"*.

The role of SHAPE in innovation at Netflix

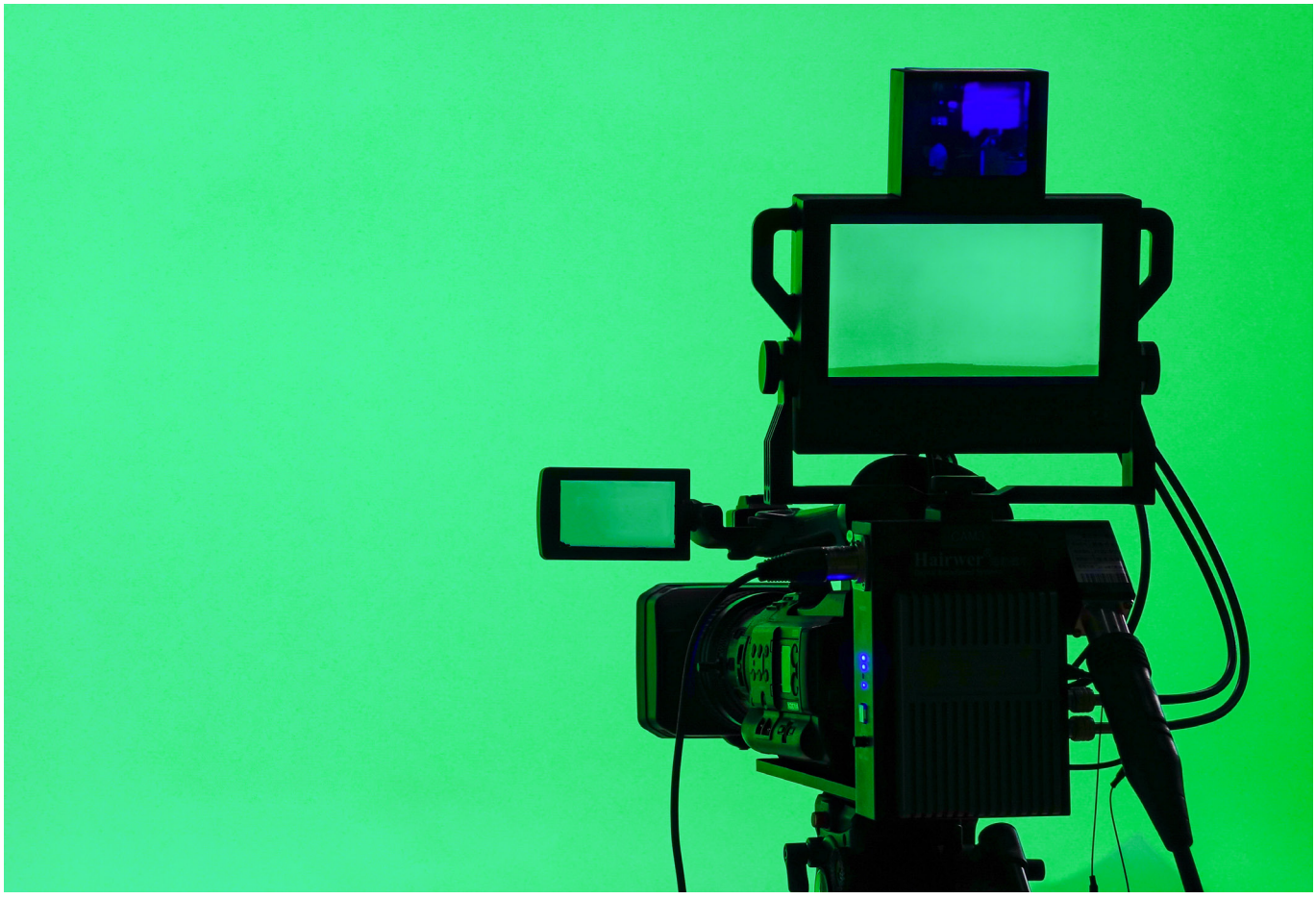
In production innovation, innovations are not necessarily about cost saving, but instead tend to focus on empowering content creators to tell "bigger, better" stories.[36] This is reflected in the formal definition of innovation used by the team at Netflix:

> Innovation is *"[a way to] identify, experiment, promote, and employ new and emerging technologies that enable content creators to tell their stories in impactful new ways"*.

Take, for example, the new Production Innovation Hub model that Netflix has established in California and South Korea. In California, the Hub fuses traditional film-making practices with technologies derived from "experiential" activities like gaming, with SHAPE insights supporting a goal to *"combine digital story-telling with the…latest and g reatest in new technology"*. A hub model provides a learning environment to bring together different teams, with different backgrounds, perspectives and experiences, to take risks. Factors which influence the location for these innovation hubs are the reputation of the location for supporting the creative industries and innovation; and the critical mass of skills workers *"representing a range of related disciplines including the arts and creative industries"*.

Interviewees recognised the importance of people working at Netflix on new innovative ideas drawing on a range of disciplines and coming from a diverse set of educational and career backgrounds. *"Traditionally you had science over here, and you had the creative industries over there, but actually by taking a broader viewpoint there are broader benefits around knowledge transfer"*. One interviewee noted the fact that there are employees working in visual effects (VFX) who have training in a mix of arts and sciences. Examples were given of an individual with a BSc in Computer Science and an MA in Multimedia Design, and another who was introduced to computer-generated art at art college and went on to study a BA in Media Production with Animation.

Creativity is at the core of what Netflix does, which puts SHAPE disciplines at the heart of production innovation at Netflix. *"Technology generates creative opportunities, and creative necessities are the mother of invention"*.



Location Planning, Tesco

Tesco has a team focused on location planning activity. Location planning at Tesco is about informing the decisions on where to open new stores in the future.[37] It also explores how to optimise the existing estate, taking account of customer, property, and competitor information. The team consists of SHAPE scientists working alongside mathematicians and other scientists. Geographers play a particularly important role in the team, bringing expertise on spatial and demographic analysis. They *"tend to think about things spatially, and that then applies to how we make decisions on opening new stores and optimising our estate for the future."* Historically, there used to be a clearer split between social scientists and other scientists, but now the roles tend to be more hybrid.

The location planning activity relies heavily on data, both internal to Tesco and from external sources. Internally, Tesco uses sources including aggregated customer data and financial and property information. This is combined with various sources of external data covering aspects like catchments, demographics, expenditure, or mobility. The team works very closely with the Customer Insights team which looks at macro and regional trends in customer behaviours. The combination of macro customer insight with local catchment knowledge is a powerful decision-making tool for the business.

Next steps for the British Academy

The Academy's work on R&D has been rooted in closing the evidence gap in understandings of R&D investment and activity, and the reality that plays out across the economy. This is critical in providing long-term learning for policymakers on how to maintain and strengthen an effective, prosperous, and stable relationship between industry and R&D. Achieving this underpins economic, societal, and political goals ranging from regional economic equality to global pandemic preparedness.

To support these goals, the Academy is committed to improving the evidence base, and therefore more efficient investment in R&D. There are three distinct stages of this process to improving understanding of: the nature of what is happening, the people needed, and the interventions required.

Therefore, the Academy will:

1. **Work to more accurately capture and measure SHAPE R&D by:**

a) Supporting policy research units within government and in academia to undertake further research to identify the barriers that prevent the UK from being inclusive of SHAPE in measures and classifications of R&D.

b Spearheading efforts to align programmes across the sector such as the British Academy's Innovation Fellowships and ESRC's Research and Innovation Caucus, as well as many others, to marshal the evidence base.

c) Continuing to showcase and evidence to policymakers the importance of connected knowledge and skills across SHAPE and STEM for successful R&D and innovation.

2. **Demonstrate the needs of an RDI system built on a holistic evidence base by:**

a) Further developing understandings of SHAPE research careers, including activity in R&D. This can inform more specific research into SHAPE graduate and postdoctoral activity in R&D, including how statistical and research organisations capture this data.

b) Working with higher education and policy stakeholders to determine the evidence needed to develop policies supporting the interdisciplinary skillsets required by businesses with high levels of R&D and innovation. This includes working with the Unit for Future Skills (led by DfE), DSIT, DCMS and DBT to support the alignment of cross-departmental agendas.

3. **Support identification and enactment of effective policy leavers by:**

a) Working with relevant stakeholders - including the other national academies, policymakers, and government departments - to identify and assess effective policy levers to incentivise connected R&D across SHAPE and STEM activities, particularly in industries where we may be undercounting R&D such as the creative industries and areas of the services sector.

b) Strengthening channels for communication across the R&D research community and with policymakers by convening a SHAPE R&D and Innovation Working Group to provide leadership on knowledge exchange and policy analysis.

c) Working with the ESRC, AHRC and other sector stakeholders to add further evidence on innovation in SHAPE research, to help policymakers, avoid the fallacy of only valuing what is currently measured.

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A note on publication timelines

In 2021, the British Academy commissioned two reports on Understanding SHAPE in R&D by RAND Europe and Frontier Economics. The Academy worked closely with the research teams and the reports were finalised in August 2022. We realise there has been a gap between the finalising of these reports and publication. However, we believe that this delay has not significantly affected the findings of these reports, which remain incredibly relevant to policy conversations across the sector, particularly in light of ongoing changes to R&D statistics methodologies at the Office for National Statistics.

Endnotes

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